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**THE ROLE OF TIMBER PLANTATIONS IN U.K. INVESTMENT
PORTFOLIOS**

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ABSTRACT

Although timber plantations and forests are classified as forms of agricultural production, the ownership of this land classification is not limited to rural producers. Timber plantations and forests are now regarded as a long-term investment with both institutional and absentee owners.

While the NCREIF property indices have been the benchmarks for the measurement of the performance of the commercial property market in the UK, for many years the IPD timberland index has recently emerged as the U.K. forest and timberland performance indicator. The IPD Forest index incorporates 126 properties over five regions in the U.K.

This paper will utilise the IPD Forestry Index to examine the performance of U.K. timber plantations and forests over the period 1981-2004. In particular, issues to be critically assessed include plantation and forest performance analysis, comparative investment analysis, and the role of plantations and forests in investment portfolios, the risk reduction and portfolio benefits of plantations and forests in mixed-asset portfolios and the strategic investment significance of U.K. timberlands.

INTRODUCTION

Timber is unique in comparison to other agricultural commodities. Unlike the majority of rural commodities, timber has a varied range of uses including construction and numerous industrial and manufacturing purposes.

In addition to the agricultural economic aspects of this land use are the added benefits of the environmental and leisure components of forests, these public benefits include:

- Provision of shelter;
- Noise reduction;
- Recreation Use
- Aesthetic qualities
- Air filtration erosion reduction;

- Reclamation of degraded pasture agricultural land;
- Carbon banks;
- Improvement of water quality (Willis et al, 2003; Maclaren, 1993).

In cases where actual forests are not economically profitable, from an agricultural and investment perspective, they can be considered essential and worthwhile land uses when these public benefits are taken into account (Willis et al, 2003; Lockie, 2002; Willis et al, 2000; Ecologically Sustainable Development Working Groups, 1991).

The dual benefit of managed timberlands, in developed and developing world economies, has resulted in both an increase in plantation areas and the regeneration of existing forest areas. These increases in managed plantations, particularly for industrial and investment uses, has been funded from both the private and public sectors (Lewis and Ferguson, 1993). According to Kanowski (1997) 90% of forests have been established for industrial purposes, with the remaining 10% for fuel production, with the greatest increase in forest plantings being in the temperate regions.

According to Lewis and Ferguson (1993), the next century of the growing of timber will be predominately based on plantation timber, with the predominant species being softwood types. This is already the main form of timber production in the Southern Hemisphere and is gaining hold, as the major plantation source in the Northern Hemisphere.

Over the past 15 years, there has been a significant increase in total forest and plantation areas in developed countries such as the UK, USA and Australia. In the UK, the percentage of total land area designated to plantations or forests has increased from 4.9% in 1908 to over 10% in 1998 (UK Forestry Commission, 1998). Forestry Commission figures indicate that this increase in total forestry area is continuing with approximately 15,000 to 20,000 hectares of new forests being planted each year and a further 15,000 hectares of felled areas being replanted. In figures compiled by Brent and Mendelsohn (1999), annual tree plantings in the US have increased from 56,000 hectares in 1930 to 981,000 hectares in 1995. The figures for Europe show a similar trend in forest areas with approximately a 5 million-hectare increase since 1960.

However, this increase in total managed timber areas, predominately in the temperate zones, has been offset to a large extent by the clearing of native rain forests for agricultural and urban land in third world countries.

As previously stated, forests provide benefits other than income from timber products. Forests are also the major source of the world's biodiversity and terrestrial carbon. Plantations and forests currently cover 27% of the world land surface but based on models of natural forest ecosystems, this coverage should be 48% of the terrestrial landscape (Brent and Mendelsohn, 1999).

Therefore, from both an economic and social aspect, the current trend of increased forest plantings should continue.

TIMBERLAND AS AN INVESTMENT

The majority of the world's forests are public owned and managed, particularly the native forests. The level of public forest ownership varies from country to country, but in the U.K. 37% of forests is public owned and managed, 20% are owned by farmers and the remaining are privately owned and managed. The level of public ownership of forests has also declined over the past 5 years from 1,081,000 hectares in 1990 to 1,011,000 hectares in 2000. During the same period, the area of private forestry plantations increased from 1,530,000 hectares to 1,782,000 hectares (, Forest Department Food and Agriculture organization of United Nations, 2005; MAFF, 1998).

From the period 2000 to 2005, the total area of woodland in the UK has increased from 2,793,000 ha to 2,845,000 ha (Department Food and Agriculture organization of United Nations, 2005)

This level of private timberland ownership is similar to other countries, such as Australia 37% but considerably less than private forest and plantation ownership in the U.S which is 73%, with approximately 60% of this area being for investment purposes rather than industrial use (Australian Bureau of Statistics, 2004; Smith, Faulkner and Powell, 1994).

Based on the current levels of private forest and plantation ownership throughout the world, combined with the general acceptance that total forest coverage of the terrestrial surface should be increased, timberlands will continue to be a major form of land investment.

Investments in timberlands range from small joint venture operations (NSW Forests, 1996) to large corporate investment groups, such as Hancock Timber Resource Group, with exposure to timberlands in excess of US\$5.2 billion (Hancock Timber Resource Group, 2006, Wood Technology, 1999).

In addition to Hancock Timber Resource Group, which is both an institutional investor as well as an industrial timber owner, larger investment institutions with global holdings in timber include:

- Prudential Insurance Plantations
- UBS Brinson
- Xylem Investments
- The Global Timber Fund
- National Superannuation.

Factors that have influenced both this trend for investments into long term forestry operations and the subsequent research have been based on the following:

Returns and Risk: Timberland provides both capital growth and also generates a large income from the low cost production of a commodity with a continuing demand and alternate uses (Eves, 2001; Holland, 1998; Thompson, 1997; Caulfield, 1994; Harris,

Deforest, Futch and Cubbage, 1989; Redmond and Cubbage, 1988).

Inflation Hedging: Prior to the work carried out by Washburn and Binkley (1993), it was always assumed that the investment in timberlands was a good hedge against inflation. The research by Washburn and Binkley now suggests that geographic location, species type and end use of the forest product can limit the inflation hedging attributes of timberland. Where these factors are favourable, timberlands do provide an inflation hedge in a diversified portfolio.

Diversification and Portfolio Benefits: Several studies have been carried out in relation to the diversification and portfolio benefits of timberland in mixed asset portfolios. This has included studies by Berler, 1998; Caulfield, 1994; 1992; Rubens and Webb, 1995; Redmond and Cubbage, 1988). These previous timberland studies have been U.S. based and used both investor based indices (Frank Russell-property index and theoretical benchmarking (Thomson, 1997).

The availability of IPD timberland price series, together with indices for the major investment products has enabled the following historical portfolio analysis to be carried out.

METHODOLOGY

Timberland Series

The U.K. timberland performance series used in this analysis are the annual IPD Forestry Index over the period 1980 to 2004. Although the index commenced in 1992 data has been provided to cover the period 1981 to 2004. This period provides total performance returns from 1981 to 2004. Details of the IPD Forestry Index series are presented in Table 1. The following series were used: total (aggregate of all types and geographic regions (North Scotland, Mid Scotland, South Scotland, North England and Wales).

The series commenced in 1981 with 26 properties and as at 2004, this figure had increased to 161 properties, with a total value of £74.4 million. Data from 1981 to 1992 included reduced expenditure from tax relief, transitional relief from 1988 to 1992. There are 106 plantations located in Scotland with 21 plantations in North England and 34 in Wales. Growth in the Index since 1992 has been predominately based on increased forests in Scotland

Age of the plantations are reasonably spread in the following age bands:

0-10 years: 8 plantations
11-20 years: 44 plantations

21-30 years: 41 plantations
31+ years: 68 plantations (IPD, 2005).

This even spread of plantation age provides a sound investment base, as either newly established plantations or only plantations nearing clearfall do not dominate the series.

Other Investment Performance Series

To provide a comparative performance analysis and mixed asset portfolio considerations, the following total return series were used:

- Property: IPD Annual Commercial Property Index return
- Equities: WM Equity weighted average Pension Fund return
- Gilts: WM Bonds weighted average Pension Fund return.

RESULTS AND DISCUSSION

Inter-asset correlation matrix

Based on the results of the inter-asset correlation matrix shown in Table 2 over the period 1980-2004, the following are the key factors of the analysis:

- Timberlands show a low correlation to both equities and gilts. These respective results were ($r = -0.16$ and -0.17);
- There is a positive significant correlation with commercial property ($r = 0.38$);
- When the commercial property market is divided into the sub-sectors of office, retail and industrial, there is a significant correlation between timberland and office ($r = 0.38$);
- The correlations between timberland and retail and industrial property were not significant ($r = 0.35$ and 0.25). However, the correlation between timberland and these property markets is stronger than the relationship of timberland to equities and gilts.

These results suggest that timberland has potential portfolio benefits in mixed asset and mixed-property portfolios.

Analysis of annual IPD Forestry series

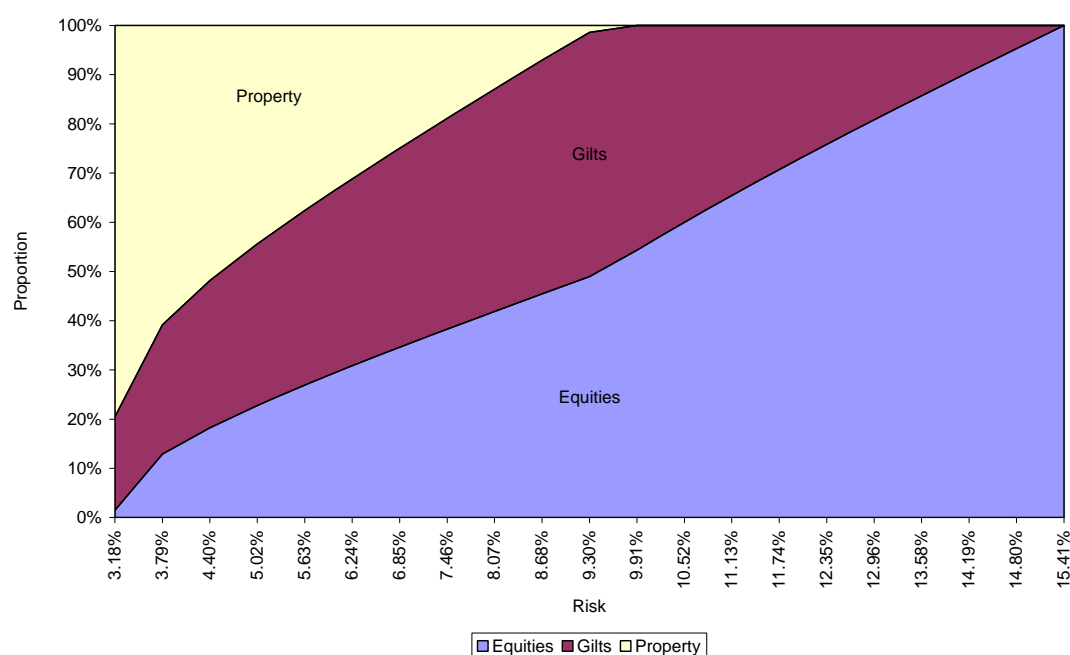
Table 3 represents the annual return, risk, risk return ratio and serial correlation structure for the IPD forestry index series over the period 1980-2004. Key factors determined from this analysis are:

- forestry returns are below those results for the other asset classes, especially in the period of 2000-2005, which saw considerable improvements in the traditional property markets;
- the average annual risk for forestry is lower than all the other asset classes, particularly equities and gilts. This reflects the long term investment nature of forests and plantations (35 to 50 years from establishment to clearfall) and the cashflow of the forests being restricted to specific age periods and skewed to the end of the investment period in all managed, clearfall plantations;
- on a risk-adjusted basis, forestry land has a significantly higher risk-return ratio than the other asset classes reflecting lesser risk-adjusted performance.
- The Sharpe index for forestry land was negative (-1.04), indicating a very volatile risk to return for this asset class. The Sharpe index for all other asset classes ranged from 0.10 (office) to 0.52 (retail).

Role of forests and plantations in optimal mixed asset allocations

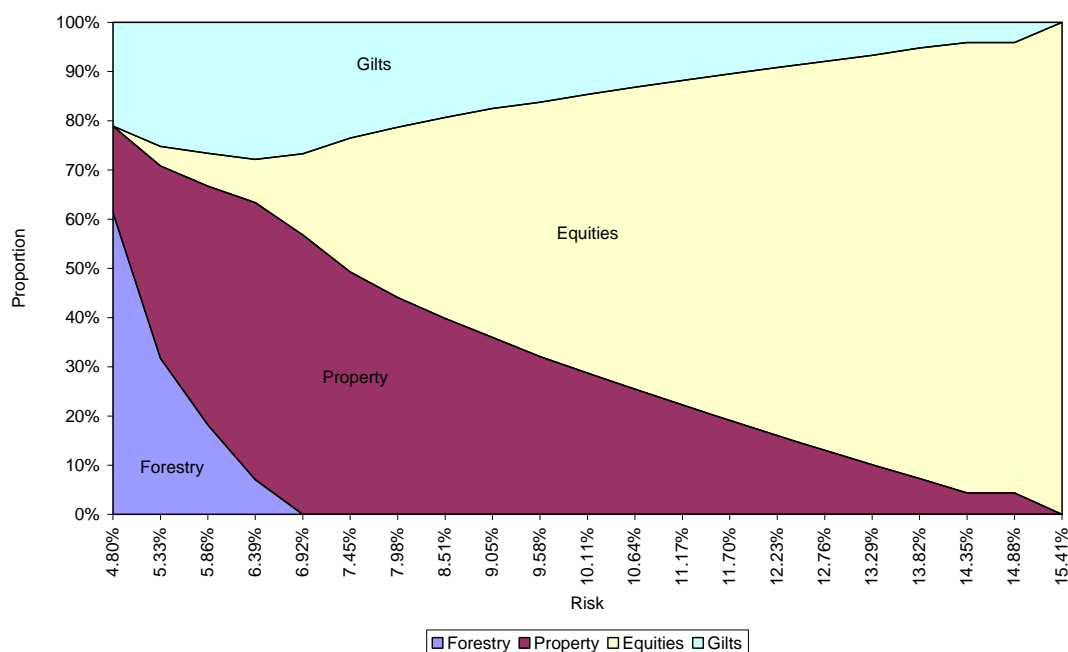
Figure 1 presents the optimal mixed asset portfolio allocation for commercial property, equities and gilts over the period 1980-2004. Commercial property comprises the majority of the optimal portfolio (80%) at low portfolio risk levels. However, as the risk increases, the level of commercial property in the portfolio reduces from a maximum of 80% to minimal levels (less than 10%) when the risk reaches 9.9%. The proportion of equities in the portfolio increases as the risk increases. Gilts come into the portfolio at low risk levels, at a smaller proportion of the portfolio compared to commercial property, but exit the portfolio when the risk level exceeds 15.41%.

Figure 1: Optimum Portfolio Allocation: Mixed-assets; 1980-2004



Including forestry in the potential investment portfolio has a significant impact on the mixed asset allocation. As demonstrated in Figure 2, the proportion of forestry land in the optimum portfolio is only significant at the lower risk levels. Although forestry plantations have the lowest risk of the traditional mixed assets, the low return only results in low proportions in the optimum portfolio at the risk level of 4.8% to 6.92%, at which level it is not represented in the optimum portfolio allocation. At the 4.8% risk level, forest land makes up 60% of the optimum portfolio allocation, at the expense of property. overall risk level of the portfolio increases from 8.17% down to 3.87% with the introduction of timberland into the portfolio. In theory, at these low levels of risk, timberland could make up to 50% of the portfolio.

Figure 2: Optimum Portfolio Allocation: Mixed-assets + Forest Land: 1980-2004



However, this level of timberland would not be practical in a balanced and diversified mixed asset portfolio. Figure 2 also indicates that under this investment scenario commercial property would not make up a significant percentage of the portfolio until the risk exceeded 5.33%, but remains in the optimum portfolio to the 15.41% risk level. Without forest land the proportion of property in the optimum portfolio is zero at the 9.91% risk level.

Figure 3 presents the optimal property portfolio allocation for office/retail/industrial property over the period 1981-2004, with Figure 4 including forestry in the optimum mixed-property investment portfolio.

These results show that the inclusion of forestry land causes some changes in the make-up of the optimum property portfolio, with a reduction in the contribution of industrial property and an increase in the proportion of retail property. Based on the returns for the period of the study, office property is not included in the mixed-property optimum asset allocation due to the lower returns, higher risk and significant

positive correlation between office and industrial and retail property. The inclusion of timberland also reduces the overall risk of the portfolio from an initial level of 7.20%, without timberland, to 5.35% when timberland is included in the portfolio.

Figure 3 Optimum Portfolio Allocation: Mixed-property: 1980-2004

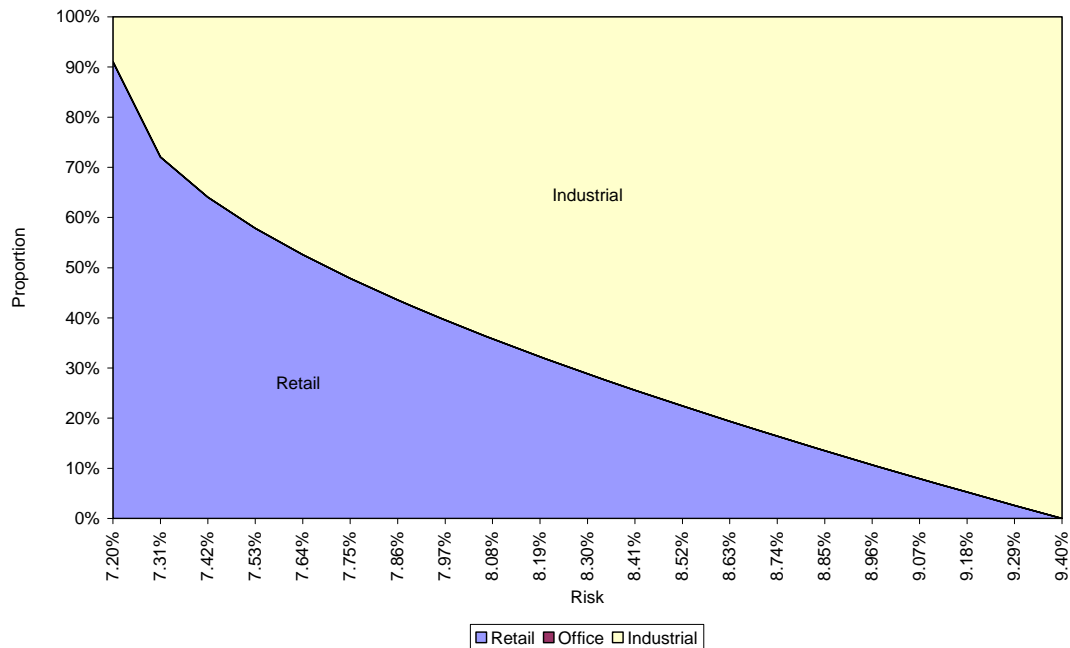
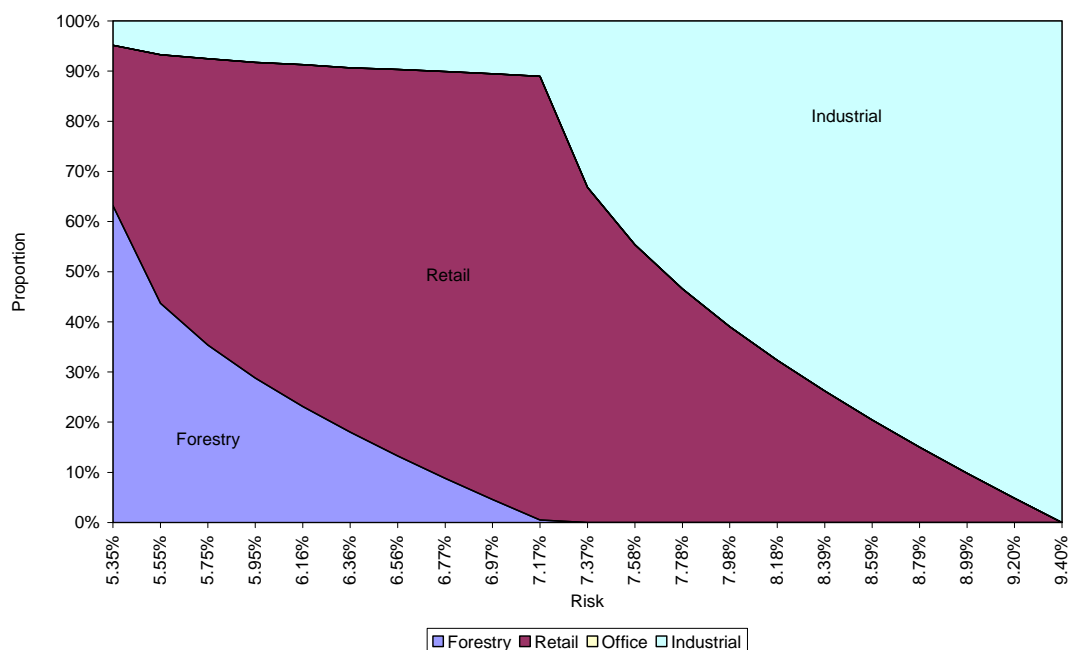


Figure 4 Optimum Portfolio Allocation: Mixed-property + Forest Land: 1980-2004



In Figure 2 it was noted that at low levels of risk the majority of the portfolio would be timberland. However, it was also noted that in a balanced mixed-asset portfolio this would not be practical. Figures 5 and 6 presents the optimal mixed-asset and mixed-property portfolio on the basis of timberland representing a maximum of 20% of the portfolio. At a maximum 20% level forestry land actually increases the overall risk of the optimum portfolios due to their low risk and very low returns.

Figure 5 Optimum Portfolio Allocation: Mixed-assets + Forest Land: 1980-2004 (Constrained 20%)

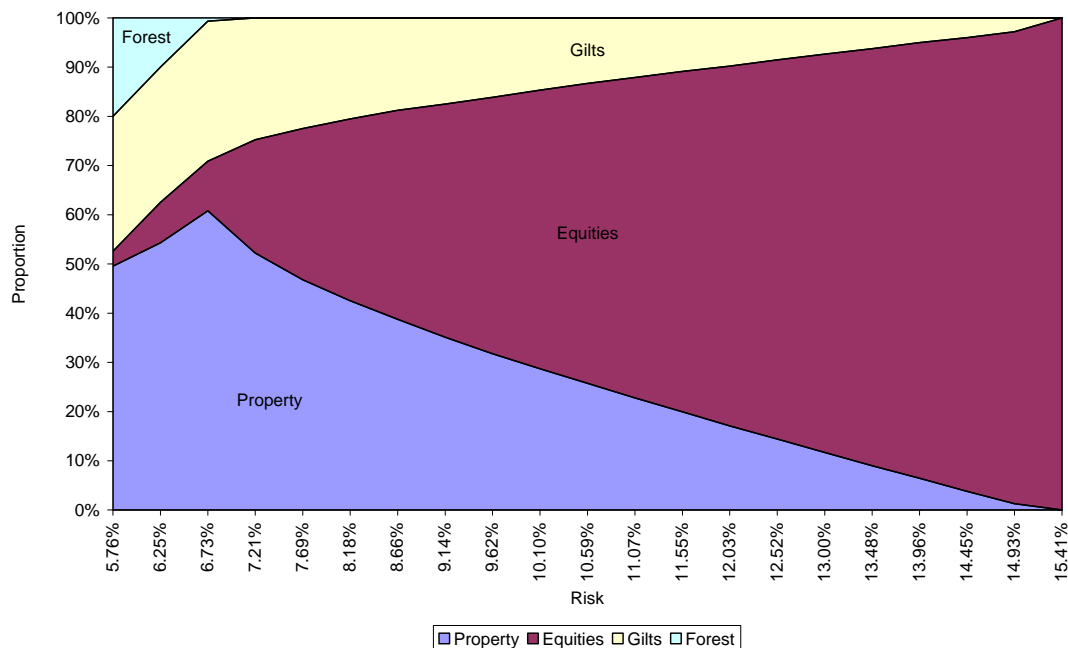
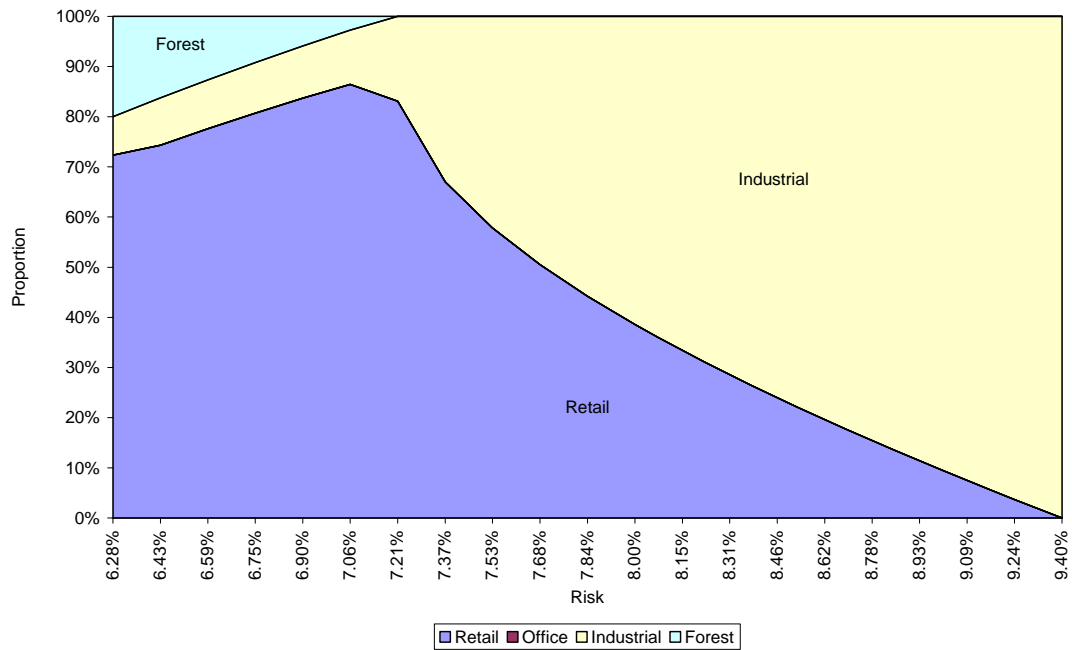


Figure 6 Optimum Portfolio Allocation: Mixed-property + Forest Land: 1980-2004 (Constrained 20%)



At a risk level of 6.73% forestry land is no longer in the optimum mixed-asset allocation, with forestry land not being represented in the optimum mixed-property portfolio at risk levels above 7.21%.

Figure 7: Efficient Frontier Comparison: Mixed-assets

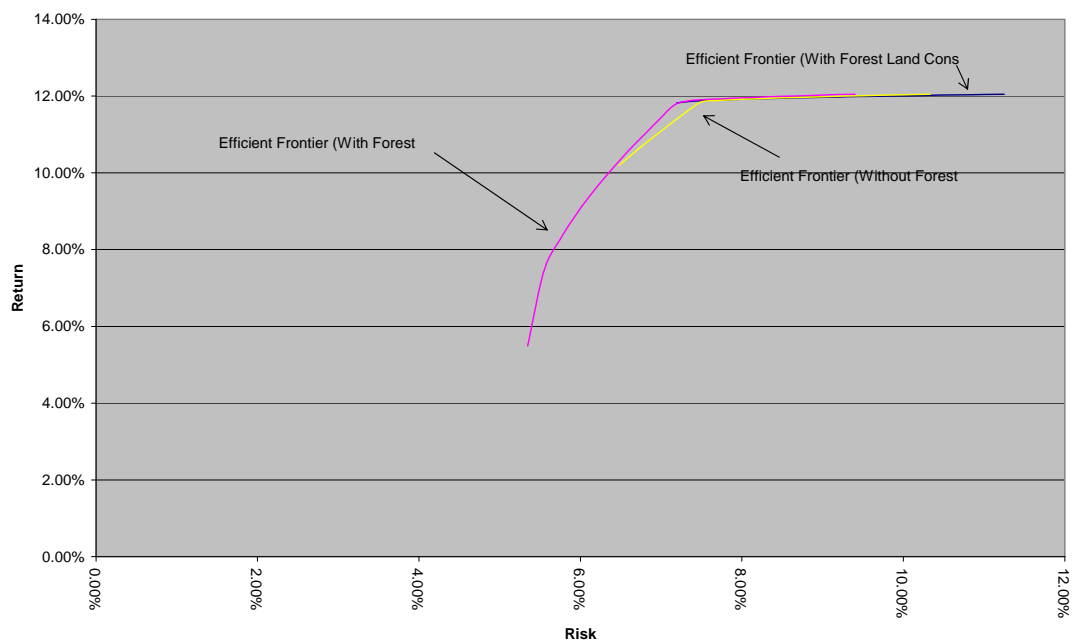
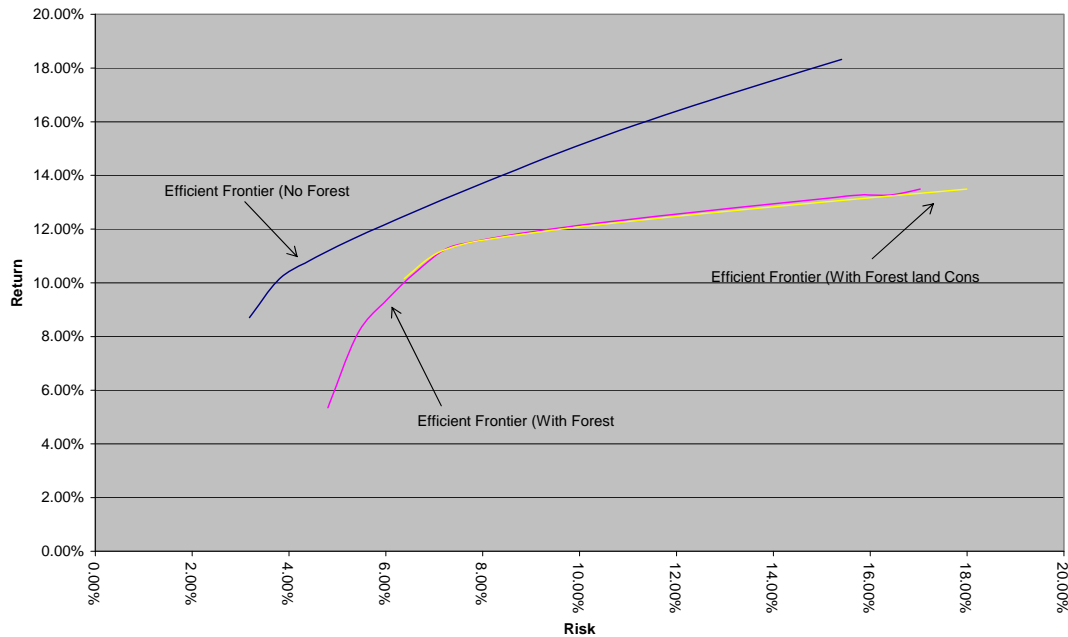


Figure 8: Efficient Frontier Comparison: Mixed-property



A comparative analysis of U.S. data has produced similar results to the above when timberland is included in the mixed asset and property investment portfolios. Inclusion of timberland in the U.S. mixed asset portfolio reduces the risk from 4.95% to 2.99%.

Figures 7 and 8 also show the minimal impact that the inclusion of forestry land currently has on the optimum mixed-asset or mixed-property allocations for the period 1980-2004.

A comparison of the Efficient Frontiers for the mixed-asset and mixed-property portfolios in Figures 7 and 8 show that constraining the percentage of forestry land in the portfolio, has limited impact on the efficient frontiers of the optimum investment portfolios.

CONCLUSIONS

The analysis of the IPD forestry performance series has provided useful insights into the risk-adjusted performance of U. K. timberland over the period 1981 to 1997. Key factors to emerge for timberland, in comparison to both mixed asset and other property sectors are:

- Timberland provides portfolio diversification benefits
- Timberland reduces the risk of the mixed-property investment portfolio, but based on the data for 1980-2004, would only increase the risk of the mixed-asset portfolio if included.
- These benefits are available at low levels of portfolio percentage

- The impact of U.K. timberland on the portfolio is similar to the impact of U.S. timberland on the U.S. mixed asset allocation.

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Table 1: Summary of IPD Forestry Index: 1981-1997

Forestry index established:	1992	
Period covered:	1981 to 2004	
Forestry index composition:	1981	
• Number of properties	26	
Forestry index composition:	2004	
• Number of properties	161	
• Regional sub-indices	North Scotland:	20 plantations
	Mid Scotland:	30 plantations
	South Scotland:	56 Plantations
	North England:	21 Plantations
	Wales:	34 Plantations
• Forest age indices:	0-10 years:	8 plantations
	11-20 years:	44 plantations
	21-30 years:	41 plantations
	31+ years:	68 plantations
• Ownership:	Private owned:	161 plantations

Table 2: Inter-asset correlation matrix: 1981-2004

	Forestry	Commercial Property	Equities	Gilts	Offices	Retail	Industrial
Forestry	1.00						
IPD Comp Property	0.38	1.00					
Equities	0.16	0.14	1.00				
Gilts	-0.17	-0.06	0.37	1.00			
Offices	0.38	0.96	0.09	-0.06	1.00		
Retail	0.35	0.92	0.23	-0.01	0.83	1.00	
Industrial	0.025	0.87	0.11	-0.09	0.02	0.71	1.00

Table 3: Analysis of IPD forestry index: 1981-2004

Characteristic	Forestry	Commercial Property	Equities	Gilts	Office	Retail	Industrial
Return (Annual %)	1.80%	10.59%	13.49%	11.33%	9.15%	11.80%	12.05%
Risk (Annual %)	6.04%	8.64%	15.414%	12.34%	10.36%	7.22%	9.40%
Risk-return ratio	3.36	0.80	1.14	1.09	1.13	0.61	0.78
Sharpe Ratio	-1.04	0.30	.0.35	.0.26	0.10	0.52	0.42
Serial correlation							
ρ_1	0.45	0.40	0.12	-0.20	0.48	0.30	0.33
ρ_2	0..07	-0.25	0.19	0.00	-0.18	-0.27	-0.16